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► To cite this version:

Michel Grangeat, David Cross, Nadia Nakhili. A Professional Community of Science Teachers and Researchers for Enacting Change in Classroom Assessment. Annual meeting of American Educational Research Association, Apr 2014, Philadelphia, United States. halshs-00983826

HAL Id: halshs-00983826

<https://shs.hal.science/halshs-00983826>

Submitted on 25 Apr 2014

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A Professional Community of Science Teachers and Researchers for Enacting Change in Classroom Assessment

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Abstract: This paper aims to specify conditions that seem fruitful for enacting change in schools. It addresses a project involving teachers from lower secondary and primary schools. The project aims to develop formative assessment within science inquiry-based teaching methods. The elements underpinning this project are described. The effects on teacher conceptions and practices are shown.

Data results from an analysis of the project material and of focus groups with the teachers involved. The methodology is based on the activity theory framework.

The results are aligned with other research that showed how fruitful it is to involve teachers within cooperative settings where they can reflect about specific professional questions and tackle complex problems with other colleagues, researchers and teacher educators from university.

1. From Professional Community to Inquiry Community

Current research findings concur with the claim that collective settings spur teacher development. Nevertheless, fruitful collective settings are to respect some conditions (Grangeat, and Gray, 2008). This paper aims to specify and evaluate conditions that seem productive for enacting change in schools, particularly in science education.

Hargreaves and Fullan (2012) noticed that 'schools [as well as teachers] improve when they collaborate with and learn from other schools [and teachers] –but not always' (p. 136). They showed that change failed to be valuable for learners if teachers are pushed to transform their practices by implementing new methods, even if such a change is underpinned by teachers' enrolment in collective based programs. They claimed that teachers need to be pulled in improving their practices when they participate in 'important work with committed and excited colleagues and leaders engaged in activities that require creativity to solve complex problem' (p. 151). They demonstrated how teachers and schools become collectively concerned by students' learning matters when they are embedded in local networks. They concluded that professional learning communities need to be appropriately designed if they aim to be productive.

Three conditions seem crucial:

- concerning professionals from a same educational sector who share common interest and motivation in resolving a specific educational problem,
- stimulating cooperation among several schools and among different kinds of professional (teachers, head of schools, inspectors, researchers and teacher educators from the university),
- underpinning the long process of teacher learning and teaching transformation by extending the time span of the program.

We propose to call this kind of collaborative settings 'Inquiry Based Continuing Professional Development program' since all the professionals involved in this IB-CPD program endeavor to resolve a common problem but none of them know the solution of this problem.

This paper addresses a specific IB-CPD program that concerns teachers from two low secondary and four primary schools of a socially disadvantaged sector in France. A first question is to describe the elements that underpin this program. A second question is to grasp the effects on teacher conception and practices.

2. Evaluating the Efficiency of a Specific IB-CPD Program

The sample consists of sixteen teachers involved in the EvaCoDICE project that aim to develop formative assessment method within science inquiry-based teaching method. This EvaCoDICE project is included in a network of collaborative settings in France —ruled by the French Institute of Education— and is part of a European project —ASSIST-ME— about assessment within science education. The EvaCoDICE project is planned to last three years from 2012 to 2015. Thus this paper concerns the first steps of the study.

A first kind of data results from an analysis of the material that was shared by the actors through a specific website and three seminars per year. This will lead to describe the structure of the studied collaborative setting.

A second kind of data is drawn from focus groups with the teachers involved in the project. This will elicit the evolution of teachers' approaches.

3. Results

The methodology is based on the activity theory framework after Engeström (2001). According to this theory, one actor's activity is understood as a system that links several key elements. This system is organized upon a main axis that links the actors, the action's object and the action's effects. The actors create meaning about the action by reflecting on their goals and their results, in other words on the difference between the initial object and the final effects. Nevertheless, as it is well known, the action and its meaning are always mediated by conceptual and physical artefacts (e.g. constructs, guidelines, tools, data base). Overall, this action is influenced by the labor organization (e.g. leadership style), by the culture of the community (e.g. the will of teacher team to spur students' achievement), and by the repertoire of actions that is available for the actors (e.g. innovative practices). These elements and this system represent a construct for understanding teacher professional knowledge (Grangeat, 2013).

3.1. Elements that underpin IB-CPD program

In this section, we will describe the different elements of the system in which teachers' activities were embedded.

3.1.1. Actors

The EvaCoDICE project concerns three types of professional team:

- A practitioner team comprised of 11 science teachers from 2 lower secondary schools and 4 primary teachers from 4 schools; all these schools were part of one educational sector that concerns socially disadvantaged people.
- A research team comprised of 5 teacher educators and 6 researchers from the university in charge of teacher education; this research team was complemented by a PhD student.
- An institutional team comprised of 2 principals of lower secondary schools, 2 persons (inspector and counselor) who rule the primary schools, and 3 persons from the regional authorities for secondary schools (inspectors and counselor).

3.1.2. Artefacts, tools, and resources

The EvaCoDICE project is based on three types of resources:

- A dedicated website which allows actors to share the project documents (courses preparations, assessment tools, meeting minutes, scientific articles, etc.).
- Three quarterly one-day seminars which concerns all the actors. These sessions were designed by the research team, with the institutional team's agreement, and their agendas were communicated to the practitioner team through the website. A report of each seminar is available on the website.
- Many meetings were set up with teacher educators in order to improve teaching material and assessment tools.

3.1.3. Repertoire of actions

Many different actions were designed in order to pull the actors within the project.

- Two rules underpin the EvaCoDICE project: the cooperation was horizontal thus no one can refer to his or her position in order to convince others; teachers' knowledge was always valuable –and improvable– since teachers experience teaching in classrooms everyday along the project.
- Seminars take place in a room that is very flexible. Chairs and tables are moved several times by seminar. Walls are used to pin posters. Works in-progress are shared and discussed easily through a video projector.
- Regional and national meetings had required actors from the three teams to present the EvaCoDICE project to other teachers, schools, and stakeholders.

3.1.4. Community and division of labor

The EvaCoDICE project was implemented in a sector where teachers and principals were used to cooperate. For many years, primary and lower secondary teachers met together in order to align their goals regarding pupils' careers. Inspectors describe themselves as counselors and critical friends who don't want to interfere with the project progress.

3.2. Effects on teacher conceptions and practices

The study will analyse the elements of the activity system which shape the action of the teachers involved in the project (Engeström, 2001). Firstly it will grasp the objects of teacher actions and the effects they noticed. Secondly, it will describe the tools and resources that seem useful for the teachers. Thirdly, and finally, it will analyze the rules that shape teachers' approaches and practices.

3.2.1. Teachers' objects and purposes

The first element of the activity system consists of the teachers' objects and purposes. During the focus groups, teachers were asked to elicit how their approaches of assessment had changed during the project first year, in terms of objects and purposes. Four main modifications are noticed.

- Assessing for learning is becoming more important than assessing for marking or ranking.
- Assessment is becoming more focused and aligned on what is essential during the course.
- Assessment is conceived as an on-going process undertaking the inherent long time needed for learning.
- Sharing a common vocabulary through the different teachers and contents is seen as essential in facilitating students' understanding.

Teachers have suggested to dedicate the project's second year to design, share, test and improve other formative assessment tools and methods.

3.2.1. Artefacts, tools, constructs and resources

The second element of the activity system consists of tools and resources that mediate teacher actions. During the focus groups, teachers were asked to elicit what tools and resources were useful in their approaches transformation. Six main sources of modification are noticed.

- The volition for making explicit and for sharing teaching material (course preparations and assessment tools) have been steered by the seminars themselves. Teachers explained that they had always wanted to act like that but without a deadline that contrives them, they had always postponed this kind of interactions with their colleagues.
- Designing the seminars and the entire project as an inquiry has made the teachers more comfortable and confident in undertaking IBST methods with their own students.
- The positive interactions among the actors and teams and the entire respect of teacher knowledge have supported the teachers in improving their practices, and have supported the necessary efforts required by the program.
- The pedagogical content knowledge provided by the research team was ranked as very helpful since, for instance, it had allowed teacher to know and to foresee the students' usual mistakes or misconceptions with respect to a specific content.
- The goals and methods of the research team that had been explained and stressed as limited and focused have supported the teachers in the limitation and focus of their expectation in their own classrooms.

Teachers have suggested improving the students' responsibility in the assessment process. They like to design tools and methods that allow their students to formulate the criteria for assessing knowledge, skills and attitude toward a scientific problem.

3.2.2. Repertoire of actions

The third element of the activity system consists of repertoire of actions that shape teacher actions. During the focus groups, teachers were asked to explain what practical changes have occurred during the past year. Changes were grasped into three main types:

- Lesson's anticipations are deepened since teachers focused on the knowledge that is requested by the problem resolution, on the nature of the hypothesis that might be tested by students and on the warrants that might be used to support their claims.
- Lessons are more aligned with student progression than with official guidelines. Thus, teachers anticipated assessment methods allowing students to monitor and check their learning activities.
- Awareness of each student activity and reflection is shared by all teachers. They explained that all their students enter within the activity and are able to justify their strategies while most of them were passive at the beginning of the year and all the other past years.

Teachers have suggested making more explicit for students what will be expected during the lesson (As a teacher, I'd like you to be able to...) and after the lesson (Strategies for homework).

3.2.3. Community and division of labour

As expected, teachers didn't explain any deep changes towards these elements. The only transformation concerned the way teachers conceived the research team: educational research methods and actors had appeared as reachable and understandable. Some teachers seemed interested in educational studies: they read articles and watch video on internet.

4. Conclusions

These results are aligned with other research that show how it is fruitful to involve teachers within cooperative settings where they can reflect about specific professional questions with other colleagues, researchers and teacher educators from university (Jaworski, 2006, van der Valk & de Jong, 2009). These cooperative settings tend to create inquiry communities between teachers and educationalists in order to promote and develop specific methods within the classroom. The key feature of these inquiry communities is that participants acknowledge and address issues and tensions within their approaches and practices. This critical alignment is both a goal and an outcome of the collective work. These studies report the way these inquiry communities supports teachers towards their goals, such as fostering students' self-esteem or involving students in their own assessment, despite their old habits and the social context which could impede these changes.

The first main characteristic of this kind of IB-CPD program is the '*push-pull* architecture' of the project: teachers and schools were pulled into by 'voluntary participation, common bonding, professional inspiration, peer assistance, practical strategies, and technical supports' (Hargreaves & Fullan, 2012, p.138). The second is the project focus on a shared professional question that underpins the collective inquiry.

These results encourage in seeking new ways to design and implement educational research in order to support educational changes that might be researched based.

5. Acknowledgment

The study was part of the ASSIST-ME project, which has received funding from the European Community's Seventh Framework Program [FP7, project number 321428].

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